

## DOCUMENT RESUME

ED 267 772

IR 012 140

AUTHOR Hanclosky, Walter V.  
TITLE A Comparison of Task Analysis, Advance Organizer, and Concept Elaboration Methods in Teaching Concepts and Principles.  
PUB DATE Jan 86  
NOTE 23p.; Paper presented at the Annual Convention of the Association for Educational Communications and Technology (Las Vegas, NV, January 16-21, 1986). For entire proceedings, see IR 012 121.  
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)  
EDRS PRICE MF01/PC01 Plus Postage.  
DESCRIPTORS Academic Achievement; \*Advance Organizers; Analysis of Variance; Cognitive Structures; Comparative Analysis; Comprehension; Concept Formation; \*Concept Teaching; Higher Education; Hypothesis Testing; \*Instructional Design; \*Intermode Differences; Literature Reviews; Research Methodology; \*Task Analysis  
IDENTIFIERS AECT Research and Theory Division Meeting; \*Elaboration Theory; Instructional Effectiveness

## ABSTRACT

Two studies were conducted to compare the advance organizer and concept elaboration models of instruction with a task analysis approach. It was hypothesized that the concept elaboration group would achieve significantly higher than either the advance organizer group or the task analysis group on concept learning and principle learning. A pilot study was conducted with a sample of 92 undergraduate teacher-education students, while the subjects for the final study were summer school students. Both groups were exposed to one of the three instructional treatments. Participants received two posttests--one taken upon completion of the instruction and one five weeks later. Each posttest consisted of 15 questions related to concept learning and 15 questions related to principle learning. The final study required additional control of potentially confounding variables. For this study, a one-way analysis of variance was performed on four independent variables of achievement (GPA), levels of experience, gender, and age. Findings from the two studies conflict; while the pilot study supported the hypotheses, findings from the final study indicate: (1) the task analysis approach seemed to be a more effective method of instruction than either concept elaboration or advance organizers in teaching concepts and principles; (2) neither the advance organizer approach nor concept elaboration appears to be superior to the other as an instructional strategy; and (3) age is apparently a more important factor in determining appropriate instructional strategies than previously expected. It is suggested that the apparent conflict between the pilot and final study results could be attributed to an age factor (22.17 years/27.35 years), and future research to investigate this possibility is suggested. A list of references is appended. (JB)

ED267772

U.S. DEPARTMENT OF EDUCATION

OEI  
EDUCATIONAL RESOURCES INFORMATION  
CENTER (ERIC)

- ☒ This document has been reproduced as received from the person or organization originating it.
- ☐ Minor changes have been made to improve reproduction quality.
- Points of view or opinions stated in this document do not necessarily represent official position or policy.

A COMPARISON OF TASK ANALYSIS, ADVANCE ORGANIZER, AND CONCEPT ELABORATION  
METHODS IN TEACHING CONCEPTS AND PRINCIPLES

Dr. Walter V. Hanclosky  
Assistant Professor of Media Arts  
Duquesne University

BEST COPY AVAILABLE

"PERMISSION TO REPRODUCE THIS  
MATERIAL HAS BEEN GRANTED BY

Michael Simonson

TO THE EDUCATIONAL RESOURCES  
INFORMATION CENTER (ERIC)."

IR012140

Instructional design should be viewed in relation to the other areas of inquiry within education. Beauchamp (1968) states that education is comprised of knowledge about instruction, curriculum, counseling, administration, and evaluation. Snelbecker (1974) compares the areas of curriculum and instruction by stating that curriculum is concerned primarily with "what" to teach while instruction is concerned with "how" to teach. Looking more specifically at the area of instruction, Reigeluth (1983) views it as being comprised of five major activities: design, development, implementation, management, and evaluation. He further states that each of these professional activities has an associated discipline which is an area of inquiry concerned with improving the performance of each activity with optimal results.

#### Instructional Design

Gordan (1968) defines instructional theory as "a set of statements based on sound replicable research, which would permit one to predict how particular changes in the educational environment would affect pupil learning" (p.3). Mayer (1981) states that because of the explosion of useful knowledge concerning human cognitive processes and memory structure within the past 10 years, instructional theory should be based on cognitive theory.

The quest for the development of broadly acceptable instructional theory has led to a growing interest in the design science of instruction (Glaser, 1976; Reigeluth, Bunderson, & Merrill, 1978). The goal of this new science is to develop a cadre of those prescriptive principles of instruction which may be applied by instructional designers and evaluators. Reigeluth and Merrill (1979) state that when a sufficient number of these principles have been identified, defined, and validated instructional designers can then prescribe methods that will optimize learning for a given set of conditions. In addition, when a set of models of teaching can be developed from these principles, they can then comprise a basis for an acceptable prescriptive theory of instruction (Reigeluth & Darwazah, 1982).

#### Task Analysis

A widely researched aspect of designing instruction deals with structuring and sequencing information. Structure refers to the general organization of instruction while sequencing "refers to the design decisions pertaining to the order in which subject matter is presented (i.e., the relationship of concepts and principles within a knowledge domain), which build upon existing cognitive structures to produce new or elaborated cognitive structures" (Tillema, 1982, p.170). A major researcher who has helped to shape this area of study is Robert Gagne (Merrill, 1977). His theory, known as the cumulative learning theory (Gagne

1968a), is based on the construction of learning hierarchies for the purpose of systematically organizing information to be learned through an analysis of the final task or behavioral outcome of the instruction.

More specifically, this task analysis begins with the final behavioral task from which all subordinate capabilities are identified. The hierarchical relationship of these capabilities is then organized by evaluating what the individual would have to know how to do in order to exhibit this new capability or task (Gagne, 1968b).

The levels of these capabilities in the hierarchy are then related to the levels of learning (Gagne and Briggs, 1974), where each capability corresponds to a type of learning classification, ie. problem solving, principle learning, concept learning, multiple discrimination. Each level or type of learning is also designed as being prerequisite to the one above and, therefore, must be learned before the student can go up the structure to successfully complete the desired task.

This analysis of prerequisite learning is necessary when designing sequences of instruction. Although the learning hierarchy itself does not directly present the desired or needed sequence of instruction, according to Gagne and Briggs (1974), it represents a kind of intuitive logic which provides a meaningful context for a design.

#### Concept/Principle Learning

The teaching of elaborate concepts and principles may pose difficulties for the application of learning hierarchies. These types of learning often require the synthesis of a multitude of obscurely related concepts or ideas whose relationships do not fit into a traditional linear sequence.

Tennyson and Boutwell (1974) define a concept as a class of objects or ideas which are characterized by the same critical attributes. If the definition is applied to a task analysis method of learning, a subject would have to exhibit competency in three major task levels: 1) remembering an instance, 2) remembering a generality, and 3) applying a generality (Merrill, Reigeluth & Faust, 1979; Merrill & Tennyson, 1977). A generality is defined as an abstract or general statement that can be applied to a variety of specific situations, such as the definition of a concept or the statement of a procedure. An instance is defined as a specific object, event, or symbol such as an example of a concept or an application of a procedure.

Reigeluth and Merrill (1979) define a principle as an operation which "specifies a cause-and-effect relationship among several event concepts" (p.14). The use of principles is generally found in the teaching of large amounts of information or macro-strategies which Reigeluth (1979) defines as "ways of organizing those aspects of instruction which relate to more than one topic, such as sequencing the topics, showing interrelationships among the topics, and

previewing or reviewing the topics" (p.8).

Two models of teaching which deal specifically with the presentation of large amounts of information or macro-strategies are the "Advance Organizer" (Ausubel, 1968) and the "Concept Elaboration Model of Instruction" (Merrill, 1977).

#### Advance Organizer

One model of teaching advocated for use in task analysis is the "Advance Organizer" (Gagne & Briggs, 1974). This model, based on the theory of meaningful learning, has been a topic of research for the past 15 years. Joyce and Weil (1980) state that the primary goal of the advance organizer is to convey large amounts of information in as meaningful and efficient a manner as possible. Therefore, the advance organizer is well designed to teach concepts and principles which require the synthesis and assimilation of subconcepts and facts into broader, more meaningful thoughts. Ausubel (1968) defines advance organizers as "appropriately relevant and inclusive introductory materials... introduced in advance of learning... and presented at a higher level of abstraction, generality, and inclusiveness" (p.148). Ausubel (1977) further states that the function of the organizer is "to provide specifically relevant anchoring ideas for the more differentiated and detailed material that is subsequently presented" (pp.167-68). This organizer may then represent a design for the optimal sequencing of those competencies necessary to successfully teach the desired principle, concept, or fact. Mayer (1979) presents five major characteristics of the advance organizer:

- (1) Short set of verbal and visual information;
- (2) Presented prior to learning a larger body of to-be-learned information;
- (3) Containing no specific content from the to-be-learned information;
- (4) Providing a means of generating logical relationships among elements in the to-be-learned information;
- (5) Influencing the learner's encoding process. (p.382)

Essentially Ausubel (1978) has identified two types of advance organizers: the expository organizer (which is used to teach completely new material) and the comparative organizer (which is used to teach familiar or relatable ideas). In both models the bulk of the synthesizing information is presented at the beginning with a brief reinforcement synthesis or summary at the end of the presentation of information.

One important characteristic of an advance organizer is that it is not designed as a summary or an overview. Summaries or overviews are presented at the same level of abstraction, generality and inclusiveness as the learning materials themselves. "They simply emphasize the salient points of the material by omitting less important

information, and largely achieve their effect by repetition and simplification" (Ausubel, 1968,p.148). The goal of the advance organizer, in contrast, is to prescribe a cognitive framework within which all subsequent instruction may logically fit.

#### Concept Elaboration

Another distinctive task analysis model of teaching and theory is the "Concept Elaboration Theory of Instruction" (Merrill, 1977). Like the advance organizer, concept elaboration prescribes a framework within which concepts, principles, or procedures may reveal logical order. However, unlike the advance organizer, in which the entire organizing structure is presented at the beginning and end of the instructional process, the concept elaboration model intersperses its organizers or epitomes throughout the entire instructional experience by moving from a general-to-detailed sequence of instruction. Reigeluth (1979) draws an analogy with the process of zooming in and out of a camera lens. In order to see all of the parts of the picture, a person starts with a wide angle view of what is to be learned. Then the person zooms in on one part, halting the zoom at different levels, to study the interrelationships of the explored part with the other parts of the picture. After part of the picture is satisfactorily explored or elaborated, the person zooms out and repeats the process with another part. After all of the significant parts of the picture have been explored, the person zooms back out to the wide-angle position. At this point, the broadest topic of the instruction, or epitome, will be satisfactorily understood.

Reigeluth and Darwazeh (1982) define an epitome as "an overview of the relationship between principles, concepts, objects, events or ideas which are presented at an application level including generalities, examples and practice" (p.31). The definition is again uniquely distinctive from the advance organizer in that it does not emphasize "higher levels of abstraction, generality, and inclusiveness" (Ausubel, 1968,p.148). Instead, it describes exactly what an advance organizer does not do, i.e. which "emphasizes the salient points of the material... and achieve their effect by repetition and simplification" (Ausubel, 1968,p.148). The concept elaboration model uniquely presents the epitomes or organizers at every level of elaborative instruction instead of only at the beginning and end of the presented information. The elaboration style of structure and sequence, therefore, naturally incorporates increasingly higher levels of abstraction, generality, and inclusiveness through a continual synthesis of information throughout the entire presentation.

An example can be found in creative writing. If a writer applies in greater detail the relationship between plot, theme, and characterization, his/her creative writing style

improves. The concept elaboration model assists the student writer by presenting the cognitive information and relationships of this information at each deeper level of the learning experience. Since this is an application approach, the student practices what he/she has learned at each level of elaboration. The result increases the students field of experience and lays the foundation for deeper investigation and understanding.

From these ideas, definitions, concepts, and principles the two structure and sequence models may be compared.

### Related Research

Three major reviews (Barnes & Lawson, 1975; Mayer, 1978; Faw & Waller, 1979) and four critiques of the reviews (Lawton & Wanska, 1977; Ausubel, 1978; Mayer, 1979; Kozlow & White, 1980) have been written about advance organizer research within the past nine years. To date there are few reviews of concept elaboration research.

In a review of concept elaboration as an emerging instructional theory, Mayer (1981) states that "in some ways the epitome is like the advance organizer, because it is intended to provide a general context for all new incoming information" (p.23). He further states that the analogical model and assimilative context for learning of the advance organizer have a relationship with the sequencing, synthesizing and summarizing components of the elaboration theory and that this relationship needs to be explored in more detail.

Mayer (1981) states, "It strikes me that the definition of an epitome should be consistent with what we know about the characteristics of advance organizers" (p.25). Therefore reviews on advance organizer research will be used to make inferences about research related to concept elaboration. The critiques (Lawton & Wanska, 1977; Ausubel, 1978; Mayer, 1979; Kozlow & White, 1980) of the reviews of earlier advance organizer research addressed the five following major problems as cited by Weil and Murphy (1982):

- 1) test measure incompatibility (Ausubel, 1978; Mayer, 1979). Most studies used tests measuring verbatim recall and ignored meaningful verbal learning and long term retention;
- 2) failure to control for existing subsumers in cognitive structure (Lawton & Wanska, 1977; Ausubel, 1978; Mayer, 1979; Kozlow & White, 1980). Lack of control for existing subsumers renders the effectiveness of the advance organizer model impossible to ascertain because subjects may have already possessed the prerequisite knowledge;
- 3) failure to assess the presence of appropriate bridge cognitive structure (Ausubel, 1978; Mayer, 1979; Kozlow & White, 1980). Subjects may lack the ideational scaffolding necessary to utilize the advance organizer;
- 4) failure to show that learners used relevant subsumers (Lawton & Wanska, 1977; Mayer, 1979); and
- 5) failure to analyze whether the main concept in the

advance organizer is an appropriate subsumer for the information in the learning material (Kozlow & White, 1980). An analysis of the conceptual content in relation to structure and sequence of the instruction to be learned is necessary before conclusions can be drawn.

In addition, another major problem found in this advance organizer research is an inequality in instructional treatment time between control and experimental groups (Weil & Murphy, 1983; Wilcox, Merrill, & Black, 1981).

#### Background of the Study

Although task analysis has been a subject of research for many years, there is little consensus (Carlisle, 1983) about what "task analysis" means or how a task analysis should be done. Davies (1973) describes task analysis in terms of its subtasks. These subtasks are used to design instruction which will reduce error in human performance. This process (Patrick & Stammers, 1978; Carlisle, 1982b, 1983; Springer & Powers, 1983) primarily requires a:

1. breakdown of the task, content etc., into constituent elements;
2. determination of the relationships among the elements; and
3. restructure in accordance with the underlying principle or optimal learning design.

The models of teaching which apply this process of task analysis are numerous and varied in their design. Two task-analysis based models dichotomous in their design are "Advance Organizer" and "Concept Elaboration." Both of these models are espoused as being reliable for teaching large concepts or principles. The advance organizer may be described as presenting synthesis instruction at the beginning of a presentation, logical sequence of instruction throughout the body of the presentation, and synthesis and/or summary instruction at the end of the presentation. The concept elaboration model, in contrast, presents synthesis, logical sequence, and summary instruction throughout the entire presentation by weaving them together at each elaborated level of instruction.

#### The Problem

The "Concept Elaboration Model of Instruction" has been linked closely with the "Advance Organizer" (Mayer, 1981). These two models may be defined as parallel in their design but divergent in their application. One major distinction is that the advance organizer presents its synthesizing and summarizing information at the beginning and end of the instruction. The concept elaboration model, on the other hand, emphasizes its synthesizing and summarizing information throughout the entire instruction, drawing interrelationships among all of the concepts, ideas,

objects, and events at each level of the elaboration.

One goal of instructional design research (Reigeluth & Merrill, 1979) is to develop a cadre of prescriptive principles which will organize information for instructional purposes. Task analysis is one method of analyzing information for instructional purposes. This analysis of information is applied primarily through the development of a learning hierarchy. It is the purpose of the learning hierarchy to graphically represent all of the specific levels of learning related to the instructional content. This hierarchy, containing the detailed information to be taught, will then provide a context for the design of instruction. Two models of teaching which use this task analysis approach are "Advance Organizer" and "Concept Elaboration."

The advance organizer model as described by Ausubel (1968) is designed to teach information through provision of "ideational scaffolding for the stable incorporation and retention of the more detailed and differentiated material that follows" (p.148). According to Reigeluth (1979), concept elaboration is primarily designed to teach information through macro-strategies which are "ways of organizing those aspects of instruction which relate to more than one topic, such as sequencing the topics, showing interrelationships among the topics, and previewing or reviewing the topics" (p.8). However, there is little or no research related to the effectiveness of the concept elaboration model of teaching. There is also little research (Wilcox, Merrill & Black, 1981) which explores these sequencing, synthesizing, and summarizing approaches to teaching concepts and principles.

From a historical perspective this general-to-detailed approach to designing instruction has substantial support. The spiral curriculum, as described by Bruner (1960), explains how anyone can be taught something about any topic of study, as long as the information is presented at the learner's appropriate reception level. Additional research on schema theory (Anderson, Spiro & Montague, 1977; Collins & Quillian, 1970; Lindsay & Norman, 1977; Rumelhart & Ortony, 1977) based on Ausubel's meaningful learning theory and Norman's (1973) web of learning based on Bruner's approach to the spiral curriculum have further advanced research in this area.

With the recent introduction of concept elaboration into the literature, Mayer (1981) states that there is a need for empirical support to further analyze and develop the theory. Mayer further notes that the relationship between the structure and sequence characteristics of the advance organizer and concept elaboration models needs to be explored in more detail.

#### Purpose of the Study

One of the purposes of instructional design research is to

validate the use of instructional principles. According to Reigeluth (1983) and Mayer (1981), the instructional principles of sequencing, synthesizing, and summarizing as they relate to teaching concepts and principles via the advance organizer and concept elaboration models of teaching are in need of exploration.

Therefore, the purpose of this study is to compare the advance organizer and concept elaboration models of teaching with a task analysis approach. This will be accomplished by ascertaining if persons given synthesis and summary instruction at every sequential level of an instructional program will achieve differently from persons given synthesis instruction only at the beginning and synthesis/summary instruction at the end of an instructional program. These two approaches will also be compared with persons given a logical sequence of instruction absent of any synthesis or summary. To maintain the integrity of each approach, all instruction will relate to the same concepts and principles.

#### Design of the Study

Because of the limited research in this area a need exists to perform an investigation to identify if different levels of achievement exist between subjects instructed through varied approaches of sequencing, synthesizing and summarizing information. One method of investigating these potential differences is to develop three instructional programs for the same topic of study. The first program is to be based on a general task analysis approach. This will be used as a basis for the development of advance organizer and concept elaboration programs.

If these three instructional programs of task analysis, advance organizer and concept elaboration are administered to randomized subjects, then the levels of achievement measured by a common evaluation instrument will determine the effectiveness of each model of instruction.

#### Limitations

Although the study will compare the advance organizer and concept elaboration models of teaching, it will compare primarily the effects of the three characteristics of sequence, synthesis, and summary common to both models. Although these are major characteristics of the models, the results will in no way reflect the greater value of one model over the other for all conditions. Instead, the significance of these results will relate only to the teaching of concepts and principles.

It need also be noted that the Advance Organizer and Concept Elaboration Theory of Instruction are primarily designed to incorporate macrostrategies or numerous teaching sessions in their design. A distinction needs to be established where a microstrategy begins and a macrostrategy ends. Examples of the models by Reigeluth (1979) and Joyce

and Weil (1980) present them to be open to interpretation. For instance, the teaching of the principle of supply and demand may be the foundation for a series of sessions in a course or a single session in a course. The importance relates to the depth of learning that is necessary and the ability of the audience to quickly understand the information being presented. This study will deal with the presentation of microstrategies or a single presentation of information as described by Joyce and Weil (1980). The pragmatic utilization of these models of teaching is necessary if the instructional theories are to have broad-based application to teachers and instructional designers.

#### The Study

It was hypothesized that the concept elaboration group would achieve significantly higher than (a) the advance organizer group and (b) the task analysis group on concept learning and principle learning when evaluated upon completion of instruction. It was further hypothesized that the advance organizer group would achieve significantly higher than the task analysis group on concept and principle learning upon completion of instruction. It was also expected that similar results would occur when assessed with an equivalent evaluation form 5 weeks after instruction.

The sample was comprised of 92 undergraduate teacher education students who were exposed to one of three instructional treatments related to task analysis, advance organizer, and concept elaboration. The three treatments were validated and pilot tested. All of the hypotheses were supported from the results of the pilot study.

This investigation required subjects to take two posttests. One was taken upon the completion of instruction; the second were taken five weeks after instruction. Each posttest consisted of fifteen questions related to concept learning and fifteen questions related to principle learning. To insure accuracy of the instruments, a Kuder-Richardson (KR-20) produced evidence of a reliability of .840 and .804 in Posttest 1 (T1) and Posttest 2 (T2) respectively.

All posttest results were then reported as: A. the sum total of concept learning in the first posttest (CON-T1); B. the sum total of principle learning in the first posttest (PRIN-T1); C. the sum total of concept learning in the second or delayed posttest (CON-T2); D. the sum total of principle learning in the second or delayed posttest (PRIN-T2); and E. the sum total of both concept and principle learning (CON/PRIN-T1/T2).

In addition posttest 1 (T1) and posttest 2 (T2) scores were compared for achievement according to the categories of A. concept learning and B. principle learning.

#### Findings Related to the Hypotheses

The final study was performed on a summer school population

which required additional control of potentially confounding variables. To control for the preidentified independent variables, a series of One Way Analyses of Variance (ANOVAs) was performed using the variables of A) levels of achievement, B) levels of experience, C) gender, and D) age. The one variable of age was found to have a significant effect. This variable was then Covaried using Analysis of Covariance (ANCOVA) for the remaining results.

A one-way analysis of variance was performed on the four independent variables of achievement (GPA), levels of experience, gender and age. The only significant finding occurred with the variable of age. An analysis of a post hoc student Newman-Keuls reported a significant difference in age between the task analysis control group and the concept elaboration group.

After the effect of age was covaried, the remaining results found the task analysis group to achieve significantly higher (.05 level) than the advance organizer and concept elaboration groups in (a) concept learning upon completion of instruction and (b) principle learning 5 weeks after instruction. The task analysis group also achieved significantly higher (.05 level) than the advance organizer group in principle learning upon completion of instruction.

The results of concept learning 5 weeks after instruction found no significant difference in achievement between any of the groups.

Therefore, the task analysis group, containing only a recommended sequence of instruction, achieved significantly higher than the advance organizer and concept elaboration groups, containing variations of sequencing, synthesizing, and summarizing of instruction, in five of eight evaluation instruments. All of these findings were in direct contrast to those anticipated, based on earlier pilot results.

### Conclusions

From the findings, it is concluded that:

1. Given the sample and instructional programs, the task analysis approach appears to be a more effective method of instruction than concept elaboration or advance organizer in teaching concepts and principles.
2. Given the sample and instructional programs, neither advance organizer nor concept elaboration appear to be superior to the other as an instructional strategy.
3. As an unanticipated outcome of the study, age is apparently a more important factor in determining appropriate instructional strategies than previously expected.

### Discussion

The findings of this investigation support the superiority

of a task analysis approach to teaching over the advance organizer and concept elaboration models. These findings are in conflict with the pilot study results and the proposed hypotheses for this study.

Based on the literature, a need exists to examine the conclusions in greater detail. First, a need exists to examine through the literature why task analysis may be a superior approach to teaching concepts and principles. Second, a need exists to explore what research or theoretical assumptions related to advance organizer or concept elaboration are either confirmed or questioned. Third, a need exists to describe the effect of age on the study and compare that effect with other research.

### Superiority of Task Analysis

Since the task analysis group emerged superior to the advance organizer and concept elaboration groups, it may be concluded that it is a superior design of instruction for the samples and treatments in this study. In the final results, the task analysis group emerged superior in the posttest 1 related to both concept and principle learning. In posttest 2 there was no significant difference between groups in concept learning; but in principle learning the task analysis group again achieved significantly higher scores than both groups. If one considers the process of prerequisite learning in task analysis (Gagne & Briggs, 1974), the subjects in this study would have needed to possess an appropriate understanding of concept learning before they could go up the learning hierarchy to principle learning. Therefore, one would have expected the task analysis group to be superior in concept learning as well as principle learning on the delayed posttest.

However, the task analysis group did perform significantly better than the advance organizer group in three out of four tests. An analysis of the instructional programs shows that the entire content of the task analysis program is contained in the advance organizer slide/ tape program. The advance organizer contained an additional number of meaningful synthesis statements at the beginning and a number of summary statements at the end of the program. The results indicate that subjects exposed to the most concise instructional program achieved the highest. It may therefore be suggested that the concepts and principle in the instructional treatment are not as complicated as previously anticipated. Instead the concepts and principle may be concrete enough to allow easy understanding through use of a brief simple program instead of the longer programs of advance organizer and concept elaboration.

Although these findings support a superiority of task analysis, it need also be recognized that all of these results are in contradiction with the pilot study results, the advance organizer literature (Ausubel, 1974), the

concept elaboration literature (Reigeluth, 1983) and learning hierarchy literature in task analysis (Gagne & Briggs, 1974).

#### Advance Organizer and Concept Elaboration

Two models which incorporate task analysis are advance organizer (Gagne & Briggs, 1974) and concept elaboration (Reigeluth, 1983). Since both of these models in the study took the sequence characteristic of task analysis and added on the elements of synthesis and summary, these programs were both longer and more comprehensive than the task analysis program. If one accepts the suggestion that the concepts and principle are not as complicated as previously anticipated, then the longer programs of advance organizer and concept elaboration may have produced boredom and fatigue in the subjects; or at least did not contribute any additional factors. This problem of unequal instructional treatment time between control and experimental groups has been acknowledged in the literature on advance organizer (Weil & Murphy, 1983; Wilcox, Merrill & Black, 1981). However, this literature would generally correlate more instruction time with increased achievement. Therefore, this assumption correlating instructional treatment time with achievement is difficult to accept.

Both of the advance organizer and concept elaboration are recommended for use with large amounts of instruction or macrostrategies. These approaches usually require instruction to be performed in more than one session. Reigeluth and Darwazeh (1982) have indicated an effort to subsume the ability to teach microstrategies into the elaboration theory. But can a macrostrategy ever be perceived as a microstrategy; and if so, when? Reigeluth (1979) presents an example of a macrostrategy in the area of economics. He states that the principle of macroeconomics require an elaborated understanding of supply and demand and debits and credits. This may in fact be an appropriate macrostrategy for a high school student; but how difficult is this principle and concept to for adult who has never had formal instruction in economics? For the adult, who is more likely to be working at a formal operations level than a high school student, this instruction may simply be a logical process which is easy to understand. Therefore, this may be perceived as a microstrategy by an adult who can quickly comprehend this information. Results of this study then pose further questions rather than clarify reasons for apparently conflicting findings.

#### Age

When age was compared between the subjects in the primary study and those in the pilot study, the means of 27.35 years and 22.17 years exist respectively for each population. This

imbalance in age is a further concern because it indicates that two substantially different age groups were represented in the pilot and primary study. Therefore, the factor of age may have contributed to the failure to reject the null hypotheses.

Because students in different courses comprised the sample of the primary study, a unique population distribution emerged. The mean age for the task analysis group was 24.87 years old, the advance organizer group was 26.68 years old, and the concept elaboration group was 30.42 years old. There was a significant difference in age between the task analysis and concept elaboration groups at the .01 level. Even though an analysis of covariance was used to statistically neutralized the effect of age on the achievement results one wonders if age could have had an effect.

Piaget (1971) in his analysis of cognitive development describes the final or formal stage of development as occurring around 12-15 years of age. This level of cognitive development is characterized by the ability to reason hypothetically. It is the opinion of many educators of adults (Long, McCrary & Ackerman, 1979) that cognitive development continues into and across adulthood. Research in this area (Elkind, 1962; Watson, 1968; Papalia, 1972; Renner & Stafford, 1972) report the existence of college and graduate age individuals who are not yet functioning at a formal operations stage. McKinnon and Renner (1971) reported only 25% of a college freshman sample to be at the formal stage. Arlin (1975) reported that 31 out of 60 female college seniors studied were classified as formal thinkers. Chiapetta (1975) found only 47% of 15 K-8 female teachers to be formal thinkers. The results of these studies suggest that age effects the development of learning styles and individual competence. Therefore the older the learner, the greater his/her chance of working at a formal operations level and achieving higher on a test requiring little to no synthesis or summary information. Within the context of this study, the older the subject the higher he/she achieved using an instructional approach which perceived the information as a microstrategy.

The results of the pilot study gave valid support for the primary study to proceed, but when the treatments were administered to different age levels a new patterns of responses occurred. The older subjects showed greater achievement with the simplest and fastest approach, the task analysis approach; the middle mean age group showed greater achievement using the more in-depth program, the advance organizer; and the younger mean age group showed greater achievement using the other more in-depth approach of concept elaboration. It then appears that the older subjects responded better to simple well sequenced instruction; the middle age subjects responded better to a well sequenced instruction with a synthesis at the beginning and a summary

at the end; and the younger subjects responded better to a well sequenced instruction with synthesizers and summarizers interspersed throughout the entire presentation of information.

An examination of the difference in ages between the pilot study (22.17 yrs.) and the primary study (27.35 yrs.) also suggest that the primary study subjects were composed of a combination traditional/nontraditional college audience. Many of the subjects who work in business or industry full-time and enroll in classes part-time may be more accustomed to dealing with short concise pieces of information from which to draw conclusions than traditional college age subjects. A traditional age subject, on the other hand, may be used to the more traditional teaching approaches. Knowles (1978) states that the traditional learners are conditioned to have a subject-oriented curriculum while adult learners tend to have a problem-centered orientation to learning. This is due to the adult's need to apply immediately what he learns, while the traditional learner continually postpones his application as he graduates from one program into another. This may explain in part why concept and principle learning were higher in the task analysis group for posttest 1 as well as why principle learning was higher in the task analysis group for posttest 2.

#### Implications for Further Research

From the conclusions of the study, a suggestion for further research is to replicate the design of this study using instructional topics of varying difficulty. This will help to correlate instructional strategies with easy-to-difficult concepts and principles. The outcome of this effort will aid in evaluating the effective parameters of task analysis, advance organizer and concept elaboration as instructional approaches to teaching. A second suggestion for further research is to replicate this study using the same traditional subject population as used in the pilot study and randomization techniques as described by Campbell and Stanley (1963).

The unanticipated results of this study have suggested consideration of correlating age with instructional strategies.

The nomenclature of the nontraditional learner emerged in the 1970s. The *Encyclopedia of Educational Research* (1969) described the standard American college student as being between 17 and 23 years of age, living on or near campus, attending classes at fixed times and determined places, and following a set curriculum of sequenced courses. Although this may still characterize the regular academic year student, the older nontraditional student has emerged on campus with a new set of needs and demands. Unfortunately much of the research in this area has related to prior experimental learning (Commission on Non-Traditional Study,

1973), adult individualized programs (Houle, 1973; Medsker, 1975), and interdisciplinary learning programs (Veysey, 1973; Change Magazine Press, 1979). However outside of the area of higher education, the adult learner has been a subject of research for the past 30 years. The results of this study may be useful in pointing new directions for research in the relationship of age to instructional strategies. A strong recommendation follows for systematic investigation of the age factor and advance organizer and concept elaboration, as well as relationships of instructional strategies for traditional and non-traditional learning populations (i.e. non-college adult learners, college degree adult learners).

**BEST COPY AVAILABLE**

## BIBLIOGRAPHY

- Anderson, R. C., Spiro, R. J., & Montague, W. E. Schooling and the acquisition of knowledge. Hillsdale, N. J.: Lawrence Erlbaum Associates, 1977.
- Angoff, W. H. Distinctions between aptitude and achievement tests. In Educational Testing Service (Ed.), Issues in testing. Princeton, N. J.: Educational Testing Service, 1980.
- Arenberg, D. Anticipation interval and age differences in verbal learning. Journal of Abnormal Psychology, 1965, 70, 419-443.
- Arlin, P. K. Cognitive development in adulthood: A fifth stage? Developmental Psychology, 1975, 5, 602-606.
- Aronson, D. T., & Briggs, L. J. Contributions of Gagne and Briggs to a prescriptive model of instruction. In C. M. Reigeluth (Ed.) Instructional-design theories and models: An overview of their current status. Hillsdale, N. J.: Lawrence Erlbaum Associates, 1983.
- Ausubel, D. P. Educational psychology: A cognitive view. New York: Holt, Rinehart & Winston, 1968.
- Ausubel, D. P. The facilitation of meaningful verbal learning in the classroom. Educational Psychologist, 1977, 12, 162-178.
- Ausubel, D. P. In defense of advance organizers: A reply to the critics. Review of Educational Research, 1979, 48, 251-257.
- Barnes, B. B., & Clawson, E. V. Do advance organizers facilitate learning? Recommendations for further research based on an analysis of thirty-two studies. Review of Educational Research, 1975, 45, 627-639.
- Beauchamp, G. A. Curriculum theory (2nd Ed.) Wilmette, Ill: Kegg Press, 1968.
- Brannigan, G. G., & Tolson, A. Sex difference in adaptive styles. Journal of Genetic Psychology, 1971, 119, 143-149.
- Bruner, J. S. Toward a theory of instruction. New York: Vintage Books, 1960.
- Burton, J. K., & Aversa, E. M. Formative evaluation information information from scripts, scratch tracks, and

- rough cuts: A comparison. Educational Communications and Technology Journal , 1979, 27 (3), 191-194.
- Campbell, D. T., & Stanley, J. C. Experimental and quasi-experimental designs for research . Chicago: Rand McNally, 1963.
- Campbell, F. B. The impact of social biases on research methods . Washington, D. C.: National Institute of Education, 1981.
- Carlisle, K. E. The learning strategy technique of task analysis. NSPI Journal , 1982, 21 (2), 9-41.
- Carlisle, K. E. The process of task analysis. Journal of Instructional Development , 1983, 6 (4), 31-35.
- Carlisle, K. E. Improving task analysis in the nuclear utility industry. NSPI Journal , 1983b, 22 (2), 8-9; 27.
- Change Magazine Press. The great core curriculum debate: Education as a mirror of culture . New Rochelle, N.Y.: The Press, 1979.
- Chiapetta, E. L. A perspective on formal thought development. Paper presented at 48th annual meeting of the National Association for Research in Science Teaching, Los Angeles, March, 1975. ED 108 862.
- Collins, A. M., & Quillian, M. R. Does category size affect categorization time? Journal of Verbal Learning and Verbal Behavior , 1972, 9 , 432-439.
- Commission on Non-Traditional Study. Diversity by design . San Francisco: Jossey-Bass, 1973.
- Davis, I. K. Task analysis: Some process and content concerns. AVCR , 1973, 21 (1), 73-85.
- Dick, W., & Carey, L. The systematic design of instruction . Glenview, Ill.: Scott, Foresman and Company, 1978.
- Donlon, I. E. Content factors in sex differences on test questions . Paper presented at the annual meeting of the American Educational Research Association, Boston, April 1971.
- Dwyer, C. A. Test content and sex differences in reading. Reading Teacher , 1976, 29 , 753-759.
- Ebel, R. L. Essentials of educational measurement (3rd Ed.). Englewood Cliffs, N. J.: Prentice-Hall, 1979.

- Elkind, D. Quantity conceptions in college students. *Journal of Social Psychology* , 1962, 57 , 459-465.
- Faw, H. W., & Waller, T. G. Mathemagenic behaviors and efficiency in learning from prose materials: Review, critique, and recommendations. *Review of Educational Research* , 1976, 46 , 691-720.
- Feather, N. T. Level of aspiration and performance variability. *Journal of Personality and Social Psychology* , 1967, 6 , 37-46.
- Gagne, R. M. Contributions of learning theory to human development. *Psychological Review* , 1968a, 75 , 177-191.
- Gagne, R. M. Learning hierarchies. *Educational Psychologist* , 1968b, 6 , 1-6.
- Gagne, R. M. The conditions of learning . New York: Holt, Rinehart & Winston, 1970.
- Gagne, R. M., & Briggs, L. J. Principles of instructional design . New York: Holt, Rinehart & Winston, 1974.
- Gay, L. R. Educational research: Competencies for analysis and application . Columbus: Merrill Publishing, 1976.
- Glaser, R. Components of a psychology of instruction: Toward a science of design. *Review of Educational Research* , 1976, 46 , 1-24.
- Gronlund, N. E. Preparing criterion-referenced tests for the classroom . New York: Macmillan, 1973.
- Hambleton, R. K., Swaminathan, H., Algina, J., & Coulson, D. B. Criterion-referenced testing and measurement: A review of technical issues and developments. *Review of Educational Research* , 1978, 48 , 1-47.
- Houle, C. The external degree . San Francisco: Jossey-Bass, 1973.
- Joyce, B. R., & Weil, M. Models of teaching (2nd ed.) Englewood Cliffs, N. J.: Prentice Hall, 1980.
- Knowles, M. S. The adult learner: A neglected species . Houston: Gulf Publishing, 1978.
- Kozlow, M. N., & White, A. L. Advance organizer research. *Evaluation in Education* , 1980, 4 , 7-48.
- Lawton, J. T., & Wanska, S. K. Advance organizers as a teaching strategy: A reply to Barnes and Clawson. *Review of Educational Research* , 1977, 47 , 233-244.

- Lindsay, P. H., & Norman, D. A. Human information processing: An introduction to psychology . New York: Academic Press, 1977.
- Long, H. B., McRay, K. J., & Ackerman, S. P. Adult Cognition. Adult Education , 1979, 30 , 2-18.
- Mayer, R. E. Advance organizers that compensate for the organization of a text. Journal of Educational Psychology , 1978, 70 , 80-86.
- Mayer, R. E. Can advance organizers influence meaningful learning? Review of Educational Research , 1979, 49 , 371-383.
- Mayer, R. E. An evaluation of the elaboration model of instruction from the perspective of assimilation theory. Journal of Instructional Development , 1981, 5 (1), 23-26.
- McKinnon, J. W., & Renner, J. W. Are colleges concerned with intellectual development? American Journal of Physics , 1971, 39 , 1047-1052.
- Medsker, L., Edelstein, S., Kreplin, H., Ruyle, J. & Shea, J. Extending opportunities for a college degree: Practices, problems, and potentials . Berkley, Calif.: Center for Research and Development in Higher Education, 1975. (ERIC Document Reproduction Service No. ED 125 418)
- Merrill, M. D. Concept analysis via concept elaboration theory. Journal of Instructional Development , 1977, 1 (1), 10-15.
- Merrill, M. D., Reigeluth, C. M., & Faust, G. W. Instructional quality profile: A curriculum evaluation and design tool. In H. F. O'Neil (Ed.) Procedures for instructional systems development . New York: Academic Press, 1979.
- Merrill, M. D., & Tennyson, R. D. Teaching concepts: an instructional design and guide . Englewood Cliffs, N. J.: Educational Technology Publications, 1977.
- Monge, R. H., & Hultsch, D. Paired-associate learning as a function of adult age and the length of the anticipation and inspection intervals. Journal of Gerontology , 1971, 26 , 157-162.
- Murphy, R. C. Sex differences in examination performance . Paper presented to the International Conference on Sex Role Stereotyping, Cardiff, Wales, 1977. (ERIC Document Reproduction Service No. ED 154 265)

- Norman, D. A. Memory, knowledge and answering questions. In R. L. Solso (Ed.) Contemporary issues in cognitive psychology: The Loyola symposium . Washington D. C.: Winston, 1973.
- Papalia, D. E. The status of several conservation abilities across the life span. Human Development , 1972, 15 , 229-243.
- Papalia, D. E., & Del Vento Bielby, D. Cognitive functioning in middle- and old-age adults. Human Development , 1974, 17 , 424-443.
- Patrick, J., & Stammers, R. Analysis for training. In J. Hartley & I. K. Davies (Eds.), Contributing to an educational technology , Vol. 2 London: Kogan Page, 1978.
- Piaget, J. Psychology and epistemology: Towards a theory of knowledge (Robin Arnold, trans.). New York: The Viking Press, 1971.
- Popham, W. J. Criterion-referenced measurement . Englewood Cliffs, N. J.; Prentice-Hall, 1978.
- Reardon, P. & Prescott, S. Sex as reported in a recent sample of psychological research. Psychology of Women Quarterly , 1977, 2 , 57-61.
- Reigeluth, C. M. In search of a better way to organize instruction: The elaboration theory. Journal of Instructional Development , 1979, 2 (3), 8-15.
- Reigeluth, C. M., Bunderson, C. V., & Merrill, M. D. What is the design science of instruction? Journal of Instructional Development , 1978, 1 (2), 11-16.
- Reigeluth, C. M., & Darwazeh, A. The elaboration theory's procedure for designing instruction. Journal of Instructional Development , 1982, 5 (3), 22-32.
- Reigeluth, C. M., & Merrill, M. D. Classes of instructional variables. Educational Technology , 1979, 19 , 5-24.
- Reigeluth, C. M., Merrill, M. D., Wilson, B. G., & Spiller, R. T. The elaboration theory of instruction: A Model for sequencing and synthesizing instruction. Instructional Science , 1980, 9 , 195-219.
- Reigeluth, C. M. Instructional-design theories and models: An overview of their current status . Hillsdale, N. J.: Lawrence Erlbaum Associates, 1983.
- Ross, E. Effects of changing and supportive instructions in verbal learning in older persons. Journal of Educational

Psychology , 1968, 57 , 261-266.

Rumelhart, D. E., & Ortony, A. The representation of knowledge in memory. In R. C. Anderson, R. J. Spiro, W. E. Montague (Eds.), Schooling and the acquisition of knowledge . Hillsdale, N. J.: Lawrence Erlbaum Associates, 1977.

Schwabacker, S. Male versus female representation in psychological research: An examination of the Journal of Personality and Social Psychology , 1970, 1971. Journal of Supplement Abstracts , 1972, 2 , 20-21.

Snelbecker, G. E. Learning theory, instructional theory, and psychoeducational design . New York: McGraw Hill, 1974.

Springer, J., & Powers, B. Visionary analysis for project outcome-setting . Presentation at the 21st Annual NSPI Convention. April 5, 1983.

Tennyson, R. D., & Boutwell, R. C. Methodology for the sequencing of instances in classroom concept teaching. Educational Technology , 1974, 14 , 45-50.

Tillema, H. Sequencing of text material in relation to information processing strategies. British Journal of Educational Psychology , 1982, 52 , 170-178.

Veysey, L. Stability and change in the undergraduate curriculum. In C. Kayson (Ed.), Content and context: Essays on college education . New York: McGraw-Hill, 1973.

Watson, P. C. Reasoning about a rule. Quarterly Journal of Experimental Psychology , 1968, 273-281.

Weil, M. L., & Murphy, J. Instruction processes. In H. Mittel (Ed.) Encyclopedia of Educational Research . New York: Free Press, Macmillan, 1982.

Wilcox, W. C., Merrill, M. D., & Black, H. B. Effect of teaching a conceptual hierarchy on concept classification performance. Journal of Instructional Development , 1981, 3 (1), 8-13.